"Perioperative Management of the Surgical Patient with Cardiovascular Disease"

George Giraud MD PhD
Professor Medicine, Physiology & Pharmacology
Thanks to Faculty and Cardiovascular Medicine Fellows who have contributed over the years

Guidelines

2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery

Found in:
Circulation or
Journal the American College of Cardiology
Perioperative Risk Calculators

- The Revised Cardiac Risk Index
- Gupta Perioperative Cardiac Risk
- American College of Surgeons National Surgical Quality Improvement Program

Preoperative Evaluation

- 10% US population undergoes noncardiac surgery annually
- risk of serious complication or death < 6% (cardiac death, MI, VT, pulmonary edema)
  - MI ≈ 1%
  - Death ≈ 0.3%
- risk increases with age
The Pre-op Consult

Phone call Tuesday afternoon

- “Surgery scheduled for early tomorrow morning”
- “Patient requires pre-op clearance”
- “Tell me a bit about the patient”
- “He looks kind of sick”

Preoperative Evaluation

Goal: open dynamic interchange of information between

- Surgeon
- Anesthesiologist
- Primary provider/medicine consultant
Preoperative Evaluation

Role of the Surgeon

• Review patient data, history and physical examination.
• Communicate severity and stability of patient's surgical condition.
• Determine if patient in optimal medical condition, given context of surgical illness.
• Obtain consultation if desired.

Preoperative Evaluation

Role of the Medical Consultant

• Evaluate patient's current medical status.
• Provide clinical risk profile.
• Provide recommendations for management of cardiac risk over entire perioperative period.
Preoperative Evaluation

Role of the Anesthesiologist
- Review patient data, history and physical examination.
- Communicate with surgeon regarding surgical approach.
- Determine optimal anesthetic approach.
- Consider post-op pain control.

Case 1
- 67 yo white male with Hx:
  - HTN
  - COPD
  - Stopped smoking 10 yrs ago
  - Obesity
  - OSA uses CPAP
- to have knee replacement
- complains of SOB with exertion
### General Approach

- History
- Medications
- Physical Examination
- Co morbid Diseases
  - Pulmonary Disease
  - Diabetes Mellitus
  - Renal Impairment
  - Hematologic Disorders
  - CAD
  - Valvular Heart Disease

### Clinical Predictors of Increased Perioperative Cardiovascular Risk

<table>
<thead>
<tr>
<th>Major Risk</th>
<th>Intermediate Risk</th>
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<tbody>
<tr>
<td>- Unstable Coronary Syndromes</td>
<td>- Mild Angina Pectoris</td>
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<tr>
<td>- Decompensated CHF</td>
<td>- Prior MI</td>
</tr>
<tr>
<td>- Significant Arrhythmias</td>
<td>- Compensated CHF</td>
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<tr>
<td></td>
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</table>
Clinical Predictors of Increased Perioperative Cardiovascular Risk

Minor
- Advanced age.
- Abnormal ECG.
- Rhythm other than sinus.
- Low functional capacity.
- History of stroke.
- Uncontrolled HTN.

Risk Depends in Part on Type of Surgery

High surgical risk:
- Aortic vascular surgery.
- Peripheral vascular surgery.
- Anticipated prolonged surgery with large fluid shifts and/or blood loss.
Risk Depends in Part on Type of Surgery

Intermediate surgical risk:
- Carotid endarterectomy
- Head and neck surgery
- Intraperitoneal and intrathoracic, orthopedic and prostate surgery

Risk Depends in Part on Type of Surgery

Low surgical risk:
- Endoscopic and superficial procedures.
- Cataract surgery.
- Breast surgery.
Case 1

• 67 yo white male with Hx:
  – HTN
  – COPD
  – Stopped smoking 10 yrs ago
  – Obesity
  – OSA uses CPAP
• to have knee replacement
• complains of SOB with exertion

Operative Factors Reflecting Risk

• Prevalence of coronary artery disease
  – Vascular & other major surgery
• Stress of prolonged mechanical ventilation
  – Intrathoracic & intraperitoneal surgery
• Fluid shifts due to blood loss
  – Orthopedic, intrathoracic & intraperitoneal surgery
Diseases Reflecting Risk

• Coronary Artery Disease (CAD).
  – Patients with known CAD.
  – Patients with major risk factors for CAD.
• Hypertension.
• Congestive Heart Failure.
• Valvular Heart Disease.
• Arrhythmias and Conduction Defects.
• Pulmonary Vascular Disease.

Case 1

• 67 yo white male with Hx:
  – HTN
  – COPD
  – Stopped smoking 10 yrs ago
  – Obesity
  – OSA uses CPAP
• to have knee replacement
• complains of SOB with exertion
**Case 2**

- 55 yo black male with Hx:
  - current smoker
  - long standing HTN
- To have cholecystectomy
- complains of abdominal pain, DOE associated with chest tightness, occasional SOB at rest, leg swelling
- P Ex: holosystolic murmur

**Noninvasive Evaluation LV Function**

Risk of complications greatest with EF<35%.

- Transthoracic echocardiogram
  - **Recommended:**
    - Poorly controlled CHF.
    - Prior CHF or dyspnea of unknown etiology.
    - Suspected significant valve disease.
  - **Not recommended:**
    - Routine test without prior CHF.
Assessment of Risk for CAD and Functional Capacity

Remember:
An estimate of
- functional capacity
- presence of preoperative myocardial ischemia
- and perioperative cardiac risk
can be determined most of the time from the history

Stress Testing

Exercise ECG test of choice
- Provides estimate of functional capacity.
- Detects myocardial ischemia.
- Can add echocardiography or myocardial perfusion to ECG testing.

Nonexercise stress testing:
- Pharmacologic myocardial perfusion studies.
- Dobutamine stress echocardiography.
Case 2

- 55 yo black male with Hx:
  - current smoker
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- To have cholecystectomy
- complains of abdominal pain, DOE associated with chest tightness, occasional SOB at rest, leg swelling
- P Ex: holosystolic murmur

Case 3

- 65yo white female with Hx:
  - HTN, obesity, hyperlipidemia
  - DOE, with normal echo except RAE & LAE
  - On warfarin for long standing AFib
- To have bilateral mastectomy for cancer
Pre & Intraoperative Therapy

Medical Therapy?
- Few randomized trials.
- Studies suggest beta-blockers reduce perioperative ischemia
- May reduce risk of MI and death

Pre & Intraoperative Therapy with beta-Blockers
- Beta-blocker indicated
  - When required to control angina
  - Patients with symptomatic arrhythmias
  - Hypertension
- Beta-blocker probably indicated when pre-op assessment identifies untreated
  - HTN
  - Known CAD
  - Major risk factors for CAD
Case 3

- 65yo white female with Hx:
  - HTN, obesity, hyperlipidemia
  - DOE, with normal echo except RAE & LAE
  - On warfarin for long standing AFib
- To have bilateral mastectomy for cancer
- What they really wanted to know was: Should we “bridge” with low MW heparin?

Risk Stratification for Periop Thromboembolism

Rechenmacher SJ, Fang JC

Bridging Anticoagulation, Primum Non Nocere.

Risk Stratification for Periop Thromboembolism

CHADS2 Score
- C Congestive Heart Failure
- H Hypertension
- A Age > 75
- D Diabetes Mellitus
- S Stroke

One point each except stroke gets 2 points

Risk Stratification for Periop Thromboembolism

Risk of Thrombus with Atrial Fibrillation
• High
  - CHADS2 score 5 or 6
  - CVA/TIA <3 months prior
  - Rheumatic valvular heart disease
• Moderate
  - CHADS2 score 3 or 4
• Low
  - CHADS2 score 2 or
  - less without prior CVA/TIA

ACCP Guidelines
Case 4

• 75yo white male with Hx:
  – HTN
  – Hyperlipidemia
  – CAD s/p CABG, EF 30%
  – Complete AV block s/p A-V sequential pacemaker
• To have hip replacement
• What if ICD goes off during surgery?

Pre/Intraoperative Management

Implanted Pacemakers and ICDs
• Switch PM to magnet mode
• Turn ICD off
• How? -- Tape external magnet over device or reprogram device
• If reprogramed, return to previous settings after surgery

• If cardioversion or defibrillation likely during surgery place anterior-posterior pads.
Intraoperative Management

Implanted Pacemakers and ICDs

• After surgery, take off magnet
  – Returns pacemaker and ICD to pre-magnet placement program

• If in doubt about pacemaker or ICD function consult cardiology or device representative

Intraoperative Considerations

Patient makes it to the OR
Intraoperative Considerations

Choice of anesthetic and intraoperative monitoring best left to discretion of anesthesia care team.

• Intraoperative patient condition is very different than pre and post-op
• Most anesthetics are vasodilatory and myocardial depressants
• Positive pressure ventilation changes cardiac loading conditions
• Third-space fluid shifts occur
• Laparoscopic surgery creates a temporary abdominal compartment syndrome – can impair ventilation and reduce venous return
Intraoperative Considerations

- 5-15 min of intraop hypotension or tachycardia is not the most common cause of MI
  - especially when the MI happens on POD #2
- most intra op myocardial ischemia is “silent”
  - even more so in the peri-anesthetic and peri-analgesic setting

Intraoperative Management

No study clearly demonstrated improved outcome from use of:
- Pulmonary artery catheter.
- ST-segment monitoring.
- Transesophageal echocardiography.
- Intravenous nitroglycerin.
- Prophylactic placement of intra-aortic balloon counterpulsation device.
Anesthetic Considerations

Perioperative Pain Management

• Patient-controlled intravenous and/or epidural analgesia is a popular
• Studies suggest effective pain management decreases postoperative catecholamine surges and hypercoagulability

Case 5

• 75 yo white male with Hx:
  – HTN, Hyperlipidemia, DM, current smoker
  – CAD s/p CABG, EF 30%, mild MR
  – Peripheral vascular disease with claudication
• Vascular team calls:
  – “We did a surgical aorto-bifemoral graft yesterday. He is not extubated yet. Can you follow along?”
Postoperative Surveillance

Post operative myocardial ischemia:
- Strongest predictor of perioperative cardiac morbidity.
- May go untreated until overt symptoms of cardiac failure develop.
- Diagnosis of perioperative MI has short and long-term prognostic value.
- 30% to 50% perioperative mortality and reduced long-term survival.

Postoperative Surveillance

Patients without evidence of CAD
- Surveillance restricted to those who develop perioperative signs of cardiovascular dysfunction.
Perioperative Surveillance

Patients with known or suspected CAD:
• ECGs at
  – baseline
  – immediately after procedure
  – and daily x 2 days
• Cardiac enzymes best reserved for patients at high risk
  – ECG abnormalities
  – Hemodynamic/cardiac dysfunction

Perioperative Surveillance

Arrhythmias most often due to non-cardiac problems:
  – Hypoxia.
  – Hypotension.
  – Metabolic derangements.
  – Infection.
Conclusion

- Use common sense
- Good judgment is better than the best test
- Use noninvasive tests appropriately
- Use coronary angiography in selected cases
- Remember, medical therapy is the core of the perioperative management of cardiovascular disease

Conclusion

Important

- Involve the patient in the decision process
- The patient bears the risk of tests, therapies and surgeries
- Even the medically unsophisticated patient has insight about themselves and can help guide decisions regarding their care
Postoperative Therapy/Future Management

Assessment and management of risk factors for:
- HR
- BP
- CAD
- Heart failure
- Hypertension
- Stroke
- Other CV disease
Assessment of Risk for Coronary Artery Disease

Coronary angiography can be used
- Risk 1/1000 of complication or death
- **dilemma** -- what to do with the results
- **dilemma** -- extent of obstructive CAD
- **dilemma** -- MI and the ruptured plaque
- **dilemma** -- morbidity and mortality of mechanical intervention

Preoperative Therapy

? Recommend: **Preoperative Coronary Angioplasty**.
- No randomized clinical trials documenting decreased incidence of perioperative cardiac events.
- No prospective studies to determine optimal period of delay.
Percutaneous Coronary Intervention

- No controlled trials comparing noncardiac surgery patients treated with preoperative PCI versus medical therapy.
- Several small observational series have suggested that cardiac death is infrequent in patients who have undergone PCI before noncardiac surgery.
- Several studies have also demonstrated a number of complications from angioplasty, including emergency CABG in some patients.

What about Stents with Angioplasty

Catastrophic outcomes of noncardiac surgery soon after coronary stenting:
40 noncardiac surgery pts
- 8 deaths
- 7 MIs
- 11 major bleeding episodes
- all MIs died
- stent thrombosis accounted for most of the fatal events

Coronary Artery Bypass Grafting

- CABG is rarely indicated simply to "get a patient through" noncardiac surgery.
- CASS database:
  - prior CABG
  - operations involving the thorax, abdomen, arterial vasculature, and head and neck
  - pts had lower mortality
- Patients who have prognostic high-risk coronary anatomy
  - should generally undergo revascularization before a noncardiac elective surgical procedure of high or intermediate risk.

Preoperative Therapy

? Recommend Preoperative CABG
- Only applicable prospective study: VA Cooperative Trial: Coronary Artery Revascularization Prophylaxis for Elective Vascular Surgery (CARP Trial)
Preoperative Therapy

Recommend: **Preoperative CABG**
- Patients with prognostic high risk coronary anatomy in whom long-term outcome would likely be improved.
- Noncardiac elective surgical procedure of high or intermediate risk.

Significant Valve Disease

- Valvular heart disease severe enough to warrant surgical treatment should have valve surgery before elective noncardiac surgery.

- Patients with severe mitral or aortic stenosis who require urgent noncardiac surgery may benefit from catheter balloon valvuloplasty.
In Pts with CHF Review
Nutritional Status

• Weight loss
• Performance status
  – normal activity
  – debilitated but ambulatory
  – <50% daytime in bed, > 50% daytime in bed
• Nutrition
  – Body mass index
  – Serum albumin level

Preoperative Intensive Care

• Goal
  – Optimize and augment oxygen delivery in patients at high risk.
• Hypothesis
  – Indices derived from pulmonary artery catheter and invasive blood pressure monitoring can be used to maximize oxygen delivery, which leads to reduction in organ dysfunction.
**Preoperative Intensive Care**

Recommendations:

- Based on scant evidence, preoperative preparation in intensive care unit may benefit certain high risk patients, particularly those with decompensated CHF.

**Intraoperative Management**

**Intraoperative Nitroglycerin**

- Insufficient data about the effects of prophylactic intraoperative intravenous nitroglycerin
- Nitroglycerin should be used only when the hemodynamic effects of other agents in use have been considered.
Perioperative Surveillance

- Supraventricular or ventricular arrhythmias with hemodynamic compromise require immediate Rx - electrical cardioversion
- Otherwise, cardioversion not recommended until precipitating causes corrected or modified

Other Issues to Consider

- Understand the timeline for surgery
- Is surgery “urgent” or is there time to sort out issues?
- Risks of delay of surgery?
- Appropriate time frame for surgery for a given patient?
- If “urgent” what are the work-flow and time frames in the preop process, OR, recovery
Other Issues to Consider

Common Occurrence
Pt referred for pre-op eval
• Pt found to have new AFib, chest pain, etc
• needs further evaluation & treatment regardless of surgery
• diagnosis of cardiac disease immediately before surgery complicates the approach

Other Issues to Consider

Consider the options
• pt with prostate cancer could have radical retropubic prostatectomy vs. radiation therapy
• pt with AAA could have open vs. endovascular repair
• Risk stratification to decide if a patient should have a procedure or which procedure has best risk/benefit ratio
Best to

Have a dialog with the requestor of the consult to:
• Frame the consult question best serve the patient
• Understand the question and how it will affect decision-making

Communicating Assessment of Risk

Clearly state your estimation of risk
• Understand in some subspecialties, there is a continuum of surgeon as complete physician to surgeon as technician
• Sometimes the patient will be better served throughout the periop period by a primary provider, internist or cardiologist
Risk Stratification for Periop Thromboembolism

Risk of Thrombus: Mechanical Heart Valve

- High
  - Mitral valve prosthesis
  - Cage-ball or tilting disc aortic valve prosthesis
  - CVA/TIA <6 months prior

ACCP Guidelines

Risk Stratification for Periop Thromboembolism

Risk of Thrombus: Mechanical Heart Valve

- Moderate
  - Bileaflet aortic valve with other risk factors (AFib, CVA/TIA, DM, CHF, age > 75 yrs)

- Low
  - Bileaflet aortic valve without other risk factors

ACCP Guidelines
Risk Stratification for Periop Thromboembolism

• High
  – Severe thrombophilia (deficiency protein C, S and antithrombin, antiphospholipid antibodies)

• Moderate
  – VTE 3–12 months prior
  – Nonsevere thrombophilia (factor V Leiden, prothrombin mutation)
  – Recurrent VTE
  – Active cancer

• Low
  – VTE >12 months prior without
  – other risk factors

ACCP Guidelines

Procedures Amenable to Uninterrupted Therapeutic Warfarin

• Cataract surgery
• Dermatologic surgery
• Dental extractions
• Epidural anesthetics and other pain techniques
• Minor noncardiac surgeries
• Total knee arthroplasty
• Arthroscopic surgery

• Endoscopy
• Biopsies
• Endovascular interventions
• Percutaneous coronary interventions
• Cardiac EP studies
• Cardiac pacemakers, defibrillators, loop recorders

ACCP Guidelines